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Thermal comfort analyses of naturally ventilated university classrooms

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Abstract

Purpose – The purpose of this paper is to analyse thermal comfort and the thermal environment in naturally ventilated classrooms. Specifically, the aims of the study were to identify the thermal environment and thermal comfort of respondents in naturally ventilated university classrooms and compare them with the ASHRAE and Indonesian National Standard (SNI); to check on whether the predicted mean vote (PMV) model is applicable or not for predicting the thermal comfort of occupants in naturally ventilated university classrooms; and to analyse the neutral temperature of occupants in the naturally ventilated university classrooms.

Design/methodology/approach – The study was carried out at the new campus of Faculty of Engineering, Hasanuddin University, Gowa campus. A number of field surveys, which measured thermal environments, namely, air temperature, mean radiant temperature (MRT), relative humidity, and air velocity, were carried out. The personal activity and clothing properties were also recorded. At the same time, respondents were asked to fill a questionnaire to obtain their thermal sensation votes (TSV) and thermal comfort votes (TCV), thermal preference, and thermal acceptance. A total of 118 respondents participated in the study. Before the survey was conducted, a brief explanation was provided to the participants to ensure that they understood the study objectives and also how to fill in the questionnaires.

Findings – The results indicated that the surveyed classrooms had higher thermal environments than those specified in the well-known ASHRAE standard and Indonesian National Standard (SNI). However, this condition did not make respondents feel uncomfortable because a large proportion of respondents voted within the comfort zone (+1, 0, and −1). The predictive mean vote using the PMV model was higher than the respondents' votes either by TSV or by TCV. There was a huge difference between neutral temperature using operative temperature (T_o) and air temperature (T_a). This difference may have been because of the small value of MRT recorded in the measured classrooms.

Originality/value – The research shows that the use of the PMV model in predicting thermal comfort in the tropic region might be misleading. This is because PMV mostly overestimates the TSV and TCV of the respondents. People in the tropic region are more tolerant to a higher temperature. On the basis of this finding, there is a need to develop a new thermal comfort model for university classrooms that is particularly optimal for this tropical area.

Keywords Thermal comfort, Air temperature, Neutral temperature, Relative humidity, Tropic area, University classroom

Paper type Research paper

Introduction

The new campus for the Faculty of Engineering, Hasanuddin University, was constructed in cooperation between the Indonesian and Japanese governments. The contract *Yen-Loan Agreement* IP-541 between the Faculty of Engineering and the Japan Bank for International Cooperation (JBIC) was signed in July 2007. The project

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